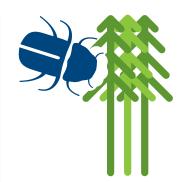
OPPORTUNITY

What are the benefits to using Biomass Boilers? **DRIVE USE OF LOCALLY** SOURCED RENEWABLE **FNFRGY**



TAKE ADVANTAGE OF WASTE WOOD

PINE-BEETLE INFESTATION HAS KILLED 17.7 MILLION ACRES OF U.S. FOREST¹

TECHNOLOGY

How do Biomass Boilers work?

POWER HOT-WATER-HEATING SYSTEMS

WITH SOLID WOOD FUEL

85%-90% EFFICIENCY RATING

M&V

Where did Measurement and Verification occur?

NATIONAL RENEWABLE ENERGY LABORATORY evaluated efficiency. cost-effectiveness, and operational functionality of a 1-million BTU biomass boiler provided by Advanced Climate Technologies at the Federal Building in Ketchikan, Alaska

RESULTS

How did Biomass Boilers perform in the M&V?

85.6% **BOILER EFFICIENCY**

AT 45% PARTIAL LOAD²; INCREASED LOAD WILL INCREASE EFFICIENCY³

HIGH **FUNCTIONALITY**

LOW 0&M COSTS⁴

YEARS

PAYBACK OPERATING AT 75% CAPACITY WITH AVERAGE PELLET COSTS⁵

< 2

< 10 10+

Payback Varies by System Size and Pellet Cost

Savings are greatest with larger systems and lower fuel costs

Pellet Cost (\$/ton)

	\$400	\$350	\$300	\$250	\$200
	PAYBACK IN YEARS				
500,000	30.7	10.7	6.5	4.7	3.6
1,000,000	24.1	8.4	5.1	3.6	2.8
1,500,000	20.9	7.3	4.4	3.2	2.5
2,000,000	18.9	6.6	4.0	2.9	2.2
2,500,000	17.5	6.1	3.7	2.6	2.1
3,000,000	16.4	5.7	3.5	2.5	1.9
3,500,000	15.6	5.4	3.3	2.4	1.8
4,000,000	14.8	5.2	3.1	2.2	1.8
	1,000,000 1,500,000 2,000,000 2,500,000 3,000,000 3,500,000	500,000 30.7 1,000,000 24.1 1,500,000 20.9 2,000,000 18.9 2,500,000 17.5 3,000,000 16.4 3,500,000 15.6 4,000,000 14.8	PAY 500,000 30.7 10.7 1,000,000 24.1 8.4 1,500,000 20.9 7.3 2,000,000 18.9 6.6 2,500,000 17.5 6.1 3,000,000 16.4 5.7 3,500,000 15.6 5.4 4,000,000 14.8 5.2	PAYBACK IN YEA 500,000 30.7 10.7 6.5 1,000,000 24.1 8.4 5.1 1,500,000 20.9 7.3 4.4 2,000,000 18.9 6.6 4.0 2,500,000 17.5 6.1 3.7 3,000,000 16.4 5.7 3.5 3,500,000 15.6 5.4 3.3 4,000,000 14.8 5.2 3.1	PAYBACK IN YEARS 500,000 30.7 10.7 6.5 4.7 1,000,000 24.1 8.4 5.1 3.6 1,500,000 20.9 7.3 4.4 3.2 2,000,000 18.9 6.6 4.0 2.9 2,500,000 17.5 6.1 3.7 2.6 3,000,000 16.4 5.7 3.5 2.5 3,500,000 15.6 5.4 3.3 2.4 4,000,000 14.8 5.2 3.1 2.2

Diesel Price \$3.63/gallon; 75% capacity factor

(At a 50% capacity factor, the payback period increases 30%)

DEPLOYMENT

Where does M&V recommend deploying Biomass Boilers?

HOT-WATER HEATED FACILITIES USING FUEL OIL

Most cost-effective for buildings in cold northern climates within 50 miles of a biomass pellet mill

¹US Forest Service, Western Bark Beetle Strategy, Human Safety, Recovery and Resiliency, 7/11/2011 ²Wood-Pellet-Fired Biomass Boiler Project at the Ketchikan Federal Building. Gregg Tomberlin (NREL), June 2014, p3 3lbid, p.12 4lbid, p.23 5lbid, p.29

